

National Aeronautics and Space Administration



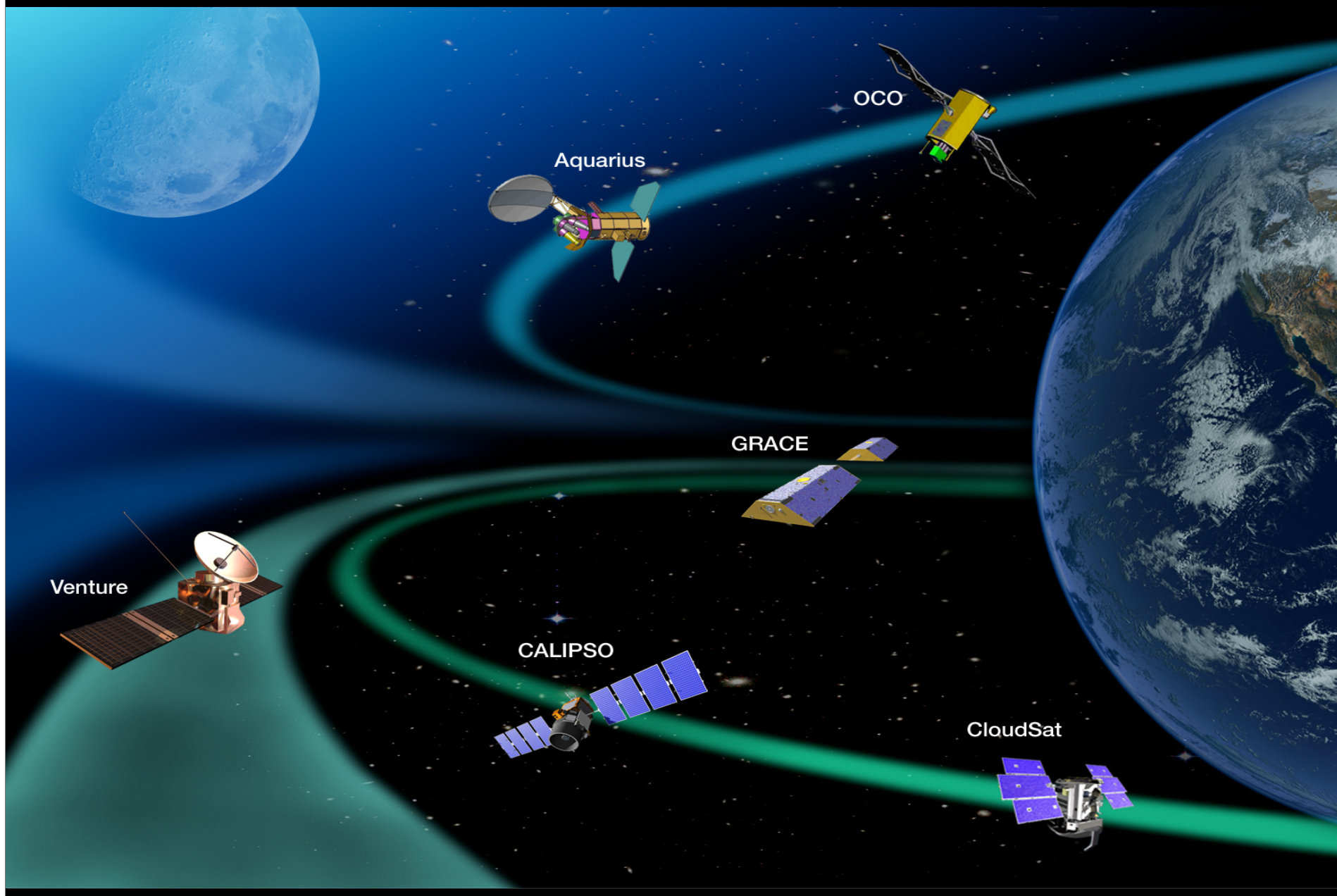
Implementing the Earth Science Flight Program

Earth Venture

Greg Stover

Deputy Program Manager, Earth System Science Pathfinder Program
Earth Science Division, Science Mission Directorate

ESSP Mission Portfolio



ESSP-based Venture Class Mission line



Venture missions will be aligned to the recommendations of the National Academy of Science 2007 Decadal Survey:

- Restore more frequent launch opportunities
- Foci:
 - ☒ Measurement and observation innovation
 - ☒ Demonstration of innovative ideas and higher-risk technologies
 - ☒ Establish new research avenues
 - ☒ Demonstrate key application-oriented measurements
- May include:
 - ☒ stand-alone missions that use simple, small instruments, spacecraft, and launch vehicles;
 - ☒ more complex instruments of opportunity flown on partner spacecraft and launch vehicles; or
 - ☒ complex sets of instruments flown on suitable suborbital platforms
- ***“...Key to the success ...will be maintaining a steady stream of opportunities for community participation in the development of innovative ideas, which requires that strict schedule and cost guidelines be enforced ...”***

Features of Venture Mission Line



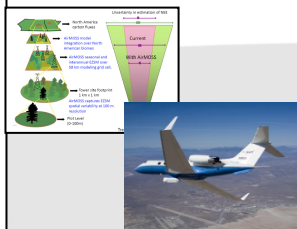
- Venture will address **exploratory** science. “Named” missions are directed and covered within the Earth Systematic Missions program
- Yearly calls as recommended by the NRC decadal survey
 - ☒ AO driven, competitively selected, PI-led projects, with science potentially be open to all earth science themes
- Optimal mix of sub-orbital, instrument and orbital mission opportunities
 - ☒ Alternate between orbital and sub-orbital
- Completion schedule required in less than 5 years from award
 - ☒ Key Decision Points will gauge performance *and continued funding*
- Projects will be cost capped
 - ☒ Total orbital mission project Life Cycle Cost of \$90M - \$150M
 - ☒ Multiple sub-orbital awards executed within same yearly budget
- Space-based calls will allow possible overlaps with decadal survey strategic missions, if they meet the other criteria (innovation, cost, schedule and science driven)
- First Earth Venture -1 (EV-1) call for airborne campaigns selection in Spring 2010.
- Subsequent calls planned for FY2011, with awards in FY2012

Earth Venture – 1 (EV-1) Investigations



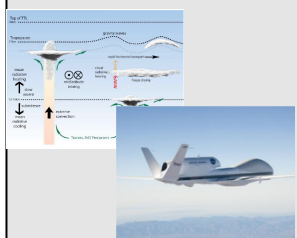
- The first set of Venture-class investigations, or Earth Venture-1 (EV-1), solicited proposals for complete suborbital, principal investigator-led investigations to conduct innovative, integrated, hypothesis or scientific question-driven approaches to pressing Earth system science issues
 - ☒ **Sustained, science-based data acquisition** — The investigations must advance Earth system science objectives through temporally sustained regional- or larger-scale measurements sufficient and necessary to prove/disprove a scientific hypothesis or address scientific questions.
 - ☒ **Mature technology** — The investigations must use mature system technology where, at a minimum, there has been a system/sub-system model or prototype demonstration in a relevant environment (Technology Readiness Level (TRL) of 6 or greater).
 - ☒ **Competitive selection** — The investigations will be selected in an open competition, to ensure broad community involvement and encourage innovative approaches.
 - ☒ **Cost and schedule constraints** — Each suborbital Venture-class investigation must have a life cycle of less than or equal to 5 years and total investigation cost not to exceed \$30 million.
- EV-1 winners announced in May 2010

EARTH VENTURE-1 SELECTION Summaries



Airborne Microwave Observatory of Subcanopy and Subsurface (AirMOSS) - Univ Mich/JPL

North American ecosystems are critical components of the global exchange of the greenhouse gas carbon dioxide and other gases within the atmosphere. To better understand the size of this exchange on a continental scale, this investigation addresses the uncertainties in existing estimates by measuring soil moisture in the root zone of representative regions of major North American ecosystems. Investigators will use NASA's Gulfstream-III aircraft to fly synthetic aperture radar that can penetrate vegetation and soil to depths of several feet.



Airborne Tropical Tropopause Experiment (ATTREX) - ARC

Water vapor in the stratosphere has a large impact on Earth's climate, the ozone layer and how much solar energy the Earth retains. To improve our understanding of the processes that control the flow of atmospheric gases into this region, investigators will launch four airborne campaigns with NASA's Global Hawk remotely piloted aerial systems. The flights will study chemical and physical processes at different times of year from bases in California, Guam, Hawaii and Australia.



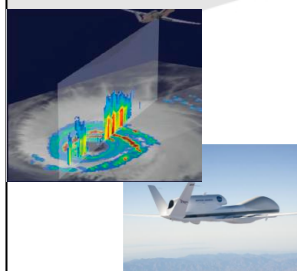
Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE) - JPL

This investigation will collect an integrated set of data that will provide unprecedented experimental insights into Arctic carbon cycling, especially the release of the important greenhouse gases such as carbon dioxide and methane. Instruments will be flown on a Twin Otter aircraft to produce the first simultaneous measurements of surface characteristics that control carbon emissions and key atmospheric gases.



Deriving Information on Surface Conditions from COLUMN and VERTically Resolved Observations Relevant to Air Quality (DISCOVER-AQ) - LaRC

The overarching objective of the DISCOVER-AQ investigation is to improve the interpretation of satellite observations to diagnose near-surface conditions relating to air quality. NASA's B-200 and P-3B research aircraft will fly together to sample a column of the atmosphere over instrumented ground stations.



Hurricane and Severe Storm Sentinel (HS3) – GSFC/ARC

The prediction of the intensity of hurricanes is not as reliable as predictions of the location of hurricane landfall, in large part because of our poor understanding of the processes involved in intensity change. This investigation focuses on studying hurricanes in the Atlantic Ocean basin using two NASA Global Hawks flying high above the storms for up to 30 hours. The Hawks will deploy from NASA's Wallops Flight Facility in Virginia during the 2012-14 Atlantic hurricane seasons.

Earth Venture – 2 (EV-2) Investigations



- The second call for Venture-class investigations, or Earth Venture-2 (EV-2), will solicit proposals for a complete, principal investigator-led mission to conduct innovative, integrated, hypothesis or scientific question-driven approach to pressing Earth system science issues
 - ☒ **Sustained, science-based data acquisition** — The successful investigation must advance Earth system science objectives through a focused orbital measurement of sufficient clarity and breadth to prove/disprove a scientific hypothesis or address scientific questions.
 - ☒ **Mature technology** — All proposed investigations must use mature system technology where, at a minimum, there has been a system/sub-system model or prototype demonstration in a relevant environment (Technology Readiness Level (TRL) of 6 or greater).
 - ☒ **Competitive selection** — The investigations will be selected in an open competition, to ensure broad community involvement and encourage innovative approaches. We expect to use a two step AO evaluation process.
 - ☒ **Cost and schedule constraints** — The successful proposal must be accomplished a life cycle from initiation to launch in less than 5 years and a total life cycle cost not to exceed \$150M, including reserves.
- EV-2 Announcement of Opportunity to be made Spring 2011, with the winning selection in early FY2012

EV-2 Mission Scope & Parameters



➤ Science Scope

- ☒ The initial AO will have an open science call.
- ☒ The mission is not intended to replace or advance individual Decadal Survey missions, however they can address portions of mission science

➤ Schedule

- ☒ The mission must have a life cycle of less than or equal to 5 years to launch and total investigation cost not to exceed \$150 million, including operations and data analysis

➤ Evaluation Criteria

- ☒ Science and mission feasibility are both critical.
- ☒ Technology development is not expected.

➤ Partnerships

- ☒ Enabling partnerships are encouraged, but the stability & reliability of the partnership will be considered as a risk element in the proposal
- ☒ Hosting an instrument on the ISS or on a partner-provided satellite are acceptable, but the partnership must be established in the proposal

EV-Instruments (EV-I) – Scope of Program



- The third leg of the Venture-class investigations, or Earth Venture-Instruments (EV-I), will solicit proposals for a complete, principal investigator-led instrument to conduct innovative, integrated, hypothesis or scientific question-driven approach to pressing Earth system science issues
 - ☒ Annual series of Instrument-Only solicitations, beginning in FY2011 with the 1st selection in FY2012
 - ☒ One-step SALMON solicitation. The investigations will be selected in an open competition, to ensure broad community involvement and encourage innovative approaches.
 - ☒ Cost capped approach, notionally \$90M per solicitation. More than one instrument may be selected within one solicitation.
 - ☒ Instruments will be flown on domestic and international flights of opportunity
 - ☒ Instrument will strive to use a common instrument interface, with the interface requirements developed by the ESSP and defined in the AO.
- The PI will retain a central role on the instrument when it is finally manifested and flown

EV-I Opportunities and Plans



➤ Science Scope

- ☒ The initial AO will have an open science call, no restrictions.
- ☒ The instruments are is not intended to replace or advance individual Decadal Survey missions, however they can address portions of mission science, or could be precursor measurements for DS missions

➤ Cost & Schedule

- ☒ The instrument(s) development time should be up to 4 years from award and must have a life cycle cost not to exceed \$90 million.

➤ Evaluation Criteria

- ☒ Science and instrument technical feasibility are both critical.
- ☒ Technology development is allowable, but only if the integrated instrument development risk still fits within the schedule and cost.

➤ Partnerships

- ☒ The proposal does not have to bring a confirmed host mission with it, however suggested or proposed manifests are allowed.
- ☒ The ESD will negotiate flight opportunities



EV Schedule	Type	Solicitation	Selection	Launch/Delivery
EV-1	Suborbital	2009	2010	
EV-2	Full Orbital	2011	2012	LRD ~2017
EV-I1	Instrument Only	2011	2012	Del ~2016
EV-I2	Instrument Only	2012	2013	Del ~2017
EV-3	Suborbital	2013	2014	
EV-I3	Instrument Only	2013	2014	Del ~2018
EV-I4	Instrument Only	2014	2015	Del ~2019
EV-4	Full Orbital	2015	2016	LRD ~2021
EV-I5	Instrument Only	2015	2016	Del ~2020
EV-I6	Instrument Only	2016	2017	Del ~2021

PPBE 2012 Earth Venture Mission Schedule